

**IN THE UNITED STATES PATENT
AND TRADEMARK OFFICE**

Applicant(s) : Kazuyuki KOJIMA
Serial No. : 10/058,439
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For : SEALING AGENT FOR LC DROPPING METHOD FOR LCD
PANELS
Art Unit : 2871
Examiner : Jeanne A. Di Grazio

Hon. Commissioner of Patents
and Trademarks
Washington, D.C. 20231

DECLARATION UNDER 37 CFR 1.132

S I R :

I. Kazuyuki KOJIMA, a citizen of Japan, who declares and says that:

I am an inventor of the present U.S. Patent Application as identified above and understand the English language. I studied the Official Action dated April 9, 2003 received in said application, and in order to prove that the present invention is not obvious over the references cited by the Examiner, the following experiments were carried out under my supervision.

II. Experiments

- (1) Preparation of Sealing agent mentioned in Example 1 of Kunihiro et al. (JP-05-295087)

A sealing agent mentioned in Example 1 of Kunihiro et al. (JP-05-295087) was prepared based on the composition

shown in the following Table 1.

Table 1

Component	Part(s)
Partially methacrylated epoxy resin	30
Dicyclopentynyl acrylate	6
Bisphenol A dimethacrylate	6
Epichloro 850S	15
1-Hydroxycyclohexylphenyl ketone	1.5
Amicure-VDH	14
Esquartz M-2010	25
KBM-403	2.5

(2) Preparation of Sealing agent of the present invention

A sealing agent of the present invention was prepared according to Example 1 mentioned in Table 1 on page 11 of the present specification as shown in the following Table 2.

Table 2

Component	Part(s)
Partially methacrylated epoxy resin	40
Epichloro 850S	15
ACR Epoxy R-1415	5
KR-02	2
Amicure-VDH	16
SS-15 (Osaka Kasei Silica)	20
KBM-403	1
KBM-1003	1

Physical properties of the thus prepared sealing agents were examined according to the following methods.

(a) Viscosity: measured by an E-type viscometer (rotor: 3"x R7.7, 10 rpm) for 3 minutes.

(b) Specific resistance: According to Measurement Method A mentioned on page 7 of the present specification, measurement was carried out as follows: 0.3 g of the sealing agent was introduced into an ampoule, and 1 ml of liquid crystal was added to it. This ampoule was placed in an oven at 100°C for 1 hour, left and returned to room temperature (25°C), then the liquid crystal was placed in liquid electrodes, an voltage of 10 V was applied across the electrodes, and after 10 minutes, the specific resistance (Ωcm) of the liquid crystals (cured product and liquid) was measured by using a specific resistance-measuring device manufactured by Toyo Technica, an electrometer 6517 (manufactured by Keithley Ltd.) and a liquid electrode LE-21 (Ando Electric Co., Ltd.).

(c) Ni point: According to Measurement Method B mentioned at the paragraph bridging pages 7 and 8 of the present specification, measurement was carried out as follows: 0.3 g of the sealing agent was introduced into an ampoule, and 1 ml of liquid crystal was added to it. This ampoule was placed in an oven at 100°C for 1 hour, then left and returned to room temperature (25°C), and the liquid crystals were placed in a DSC cell and measured for their peak temperature at an increasing temperature of 10°C/min by using a thermal analyzer DT-40 (manufactured by Shimadzu Corporation).

(d) Out gas amount: According to Measurement Method C mentioned on page 8 of the present specification, measurement was carried out as follows: 10 mg of the sealing agent was placed in a TG (thermogravimetry) cell and left at 120°C for 60 minutes, and then the reduction in weight was measured by using Thermo Plus TG8120 (manufactured by

Rigaku, Japan).

(e) Conductivity: After curing the sealing agent at certain curing conditions (UV 3000 mJ, and further at 120°C for one hour, the cured product was crushed, and to 0.5 g of the crushed material was added 50 ml of pure water and the mixture was placed in a Teflon cup. The sealed Teflon cup was treated at 121°C for 21 hours, and then returned to room temperature, and conductivity of the pure water was measured by an electrical conductance meter (manufactured by Horiba Ltd., Japan).

(f) Orientation: A seal pattern was drawn on a pair of glass substrates (test panels) having an oriented film which has been subjected to rubbing treatment, and the test panels were bonded by an LC dropping method. The bonded panels were subjected to liquid crystal re-orientation treatment by UV irradiation and heating, and orientation property near to the sealing agent was confirmed.

(g) Sealing property: By using the test panel used for the above test (f), sealing property was confirmed.

(3) Results of the experiments

The test results of the above-mentioned experiments are shown in Table 3 (Example 1 of JP-05-295087) and Table 4 (Example 1 of the present invention) below.

Table 3





Tested items	Measured value
(a) Viscosity	110,000 mPa·s, TI: 1.1
(b) Specific resistance	$7.91 \times 10^{11} \Omega\text{cm}$ (Blank: $1.12 \times 10^{13} \Omega\text{cm}$)
(c) Ni point	71.6°C (Blank: 74.6°C)
(d) Out gas amount	-1.87% by weight
(e) Conductivity	15.0 $\mu\text{S/cm}$
(f) Orientation at panel	X (Orientation failure exists) 
(g) Sealing property	Due to pressure difference between an inner pressure and an outer pressure of the panel, seal failure (penetration) occurred. No sealing can be done. 

Table 4

Tested items	Measured value
(a) Viscosity	367,000 mPa·s, TI: 1.1
(b) Specific resistance	$4.56 \times 10^{12} \Omega\text{cm}$ (Blank: $1.12 \times 10^{13} \Omega\text{cm}$)
(c) NI point	74.1°C (Blank: 74.6°C)
(d) Out gas amount	-0.1% by weight
(e) Conductivity	10.0 $\mu\text{S/cm}$
(f) Orientation at panel	O (No orientation failure exists) 
(g) Sealing property	Good sealing. 

When the above results are recalculated with regard to the values defined in Claim 1 of the present invention, the results are shown in Table 5 below.

Table 5

	Example 1 of the present invention	Example 1 of JP-05-295087
Method A (Specific resistance)	3.0%* ¹	8.75%* ²
Method B (Ni point)	0.5°C	3.0°C
Method C (out gas amount)	0.1% by weight	1.87% by weight

$$*1: [(\log(1.12 \times 10^{13}) - \log(4.56 \times 10^{12})) / \log(1.12 \times 10^{13})] \times 100 = (13.04 - 12.65) / 13.04 \times 100 = 3.0\%$$

$$*2: [(\log(1.12 \times 10^{13}) - \log(7.91 \times 10^{11})) / \log(1.12 \times 10^{13})] \times 100 = (13.04 - 11.898) / 13.04 \times 100 = 8.75\%$$

As can be seen from the above results, the sealing agent of the present invention showed markedly excellent orientation and sealing properties. To the contrary, the sealing agent of the reference does not satisfy the requirement of the present invention, and orientation failure and sealing failure occurred. Thus, any sealing agent which does not satisfy the requirement of the present invention cannot show excellent orientation and sealing properties.

III. Conclusion

From the results shown in the above-mentioned Tables, when the results of the sealing agent of the present invention and that of JP-05-295087 are compared to each other, it was found that the sealing agent of the present invention to be used for an LC dropping method for preparing LCD panels has excellent orientation property and sealing properties as compared with that of the sealing agent shown in the reference cited by the Examiner.

Such effects of the present invention would indeed be remarkable and could not be expected from the description

of the cited reference. Thus, I do not believe that the present invention can be easily expected from the descriptions of the reference.

IV. I further declare that all statements made herein of my own knowledge are true and that all statements made in information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001, of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated: September 5, 2003

Kazuyuki Kojima

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